

2N5088, 2N5089

Amplifier Transistors

NPN Silicon

Features

- Pb-Free Packages are Available*

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector – Emitter Voltage	V_{CEO}	30 25	Vdc
Collector – Base Voltage	V_{CBO}	35 30	Vdc
Emitter – Base Voltage	V_{EBO}	3.0	Vdc
Collector Current – Continuous	I_C	50	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	1.5 12	W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	83.3	°C/W

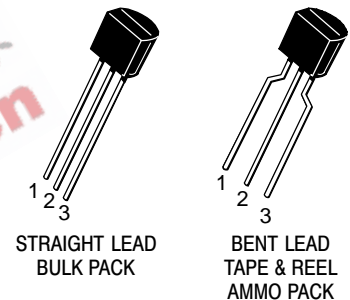
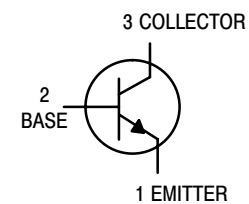
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.

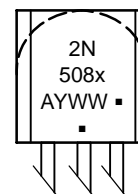


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MARKING DIAGRAM



x = 8 or 9

A = Assembly Location

Y = Year

WW = Work Week

■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
2N5088G	TO-92 (Pb-Free)	5000 Units/Bulk
2N2088RLRAG	TO-92 (Pb-Free)	2000/Tape & Reel
2N5089G	TO-92 (Pb-Free)	5000 Units/Bulk
2N2089RLRE	TO-92	2000/Tape & Reel

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector – Emitter Breakdown Voltage (Note 2) (I _C = 1.0 mA _{dc} , I _B = 0)	2N5088 2N5089	V _{(BR)CEO}	30 25	– –	V _{dc}
Collector – Base Breakdown Voltage (I _C = 100 μA _{dc} , I _E = 0)	2N5088 2N5089	V _{(BR)CBO}	35 30	– –	V _{dc}
Collector Cutoff Current (V _{CB} = 20 V _{dc} , I _E = 0) (V _{CB} = 15 V _{dc} , I _E = 0)	2N5088 2N5089	I _{CBO}	– –	50 50	nA _{dc}
Emitter Cutoff Current (V _{EB(off)} = 3.0 V _{dc} , I _C = 0) (V _{EB(off)} = 4.5 V _{dc} , I _C = 0)		I _{EBO}	– –	50 100	nA _{dc}
ON CHARACTERISTICS					
DC Current Gain (I _C = 100 μA _{dc} , V _{CE} = 5.0 V _{dc})	2N5088 2N5089	h _{FE}	300 400	900 1200	–
(I _C = 1.0 mA _{dc} , V _{CE} = 5.0 V _{dc})	2N5088 2N5089		350 450	– –	
(I _C = 10 mA _{dc} , V _{CE} = 5.0 V _{dc}) (Note 2)	2N5088 2N5089		300 400	– –	
Collector – Emitter Saturation Voltage (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc})		V _{CE(sat)}	–	0.5	V _{dc}
Base – Emitter On Voltage (I _C = 10 mA _{dc} , V _{CE} = 5.0 V _{dc}) (Note 2)		V _{BE(on)}	–	0.8	V _{dc}
SMALL-SIGNAL CHARACTERISTICS					
Current – Gain – Bandwidth Product (I _C = 500 μA _{dc} , V _{CE} = 5.0 V _{dc} , f = 20 MHz)		f _T	50	–	MHz
Collector – Base Capacitance (V _{CB} = 5.0 V _{dc} , I _E = 0, f = 1.0 MHz)		C _{cb}	–	4.0	pF
Emitter – Base Capacitance (V _{EB} = 0.5 V _{dc} , I _C = 0, f = 1.0 MHz)		C _{eb}	–	10	pF
Small-Signal Current Gain (I _C = 1.0 mA _{dc} , V _{CE} = 5.0 V _{dc} , f = 1.0 kHz)	2N5088 2N5089	h _{fe}	350 450	1400 1800	–
Noise Figure (I _C = 100 μA _{dc} , V _{CE} = 5.0 V _{dc} , R _S = 1.0 kΩ, f = 1.0 kHz)	2N5088 2N5089	NF	– –	3.0 2.0	dB

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

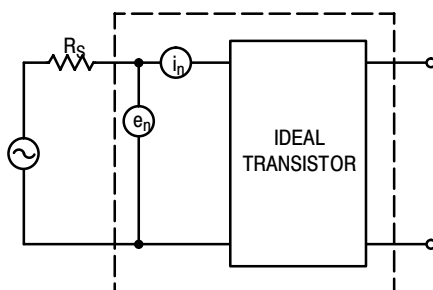


Figure 1. Transistor Noise Model

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NOISE CHARACTERISTICS

($V_{CE} = 5.0 \text{ Vdc}$, $T_A = 25^\circ\text{C}$)

NOISE VOLTAGE

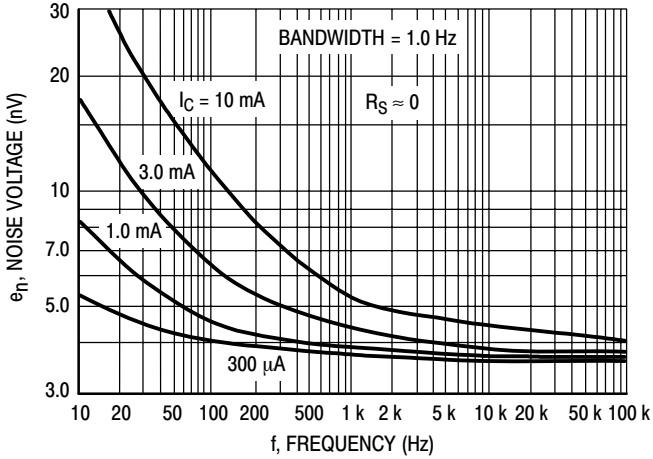


Figure 2. Effects of Frequency

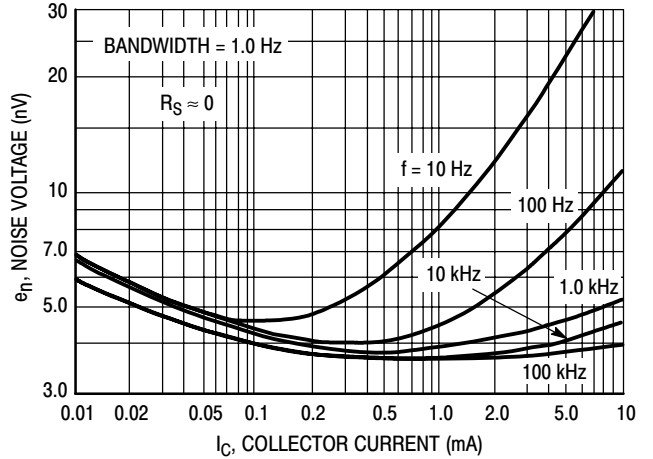


Figure 3. Effects of Collector Current

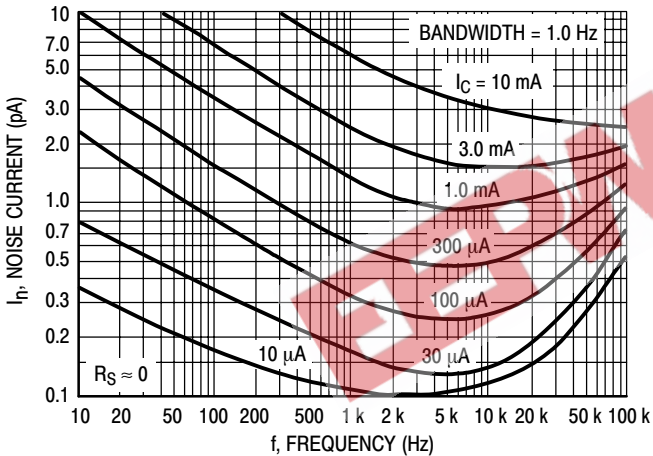


Figure 4. Noise Current

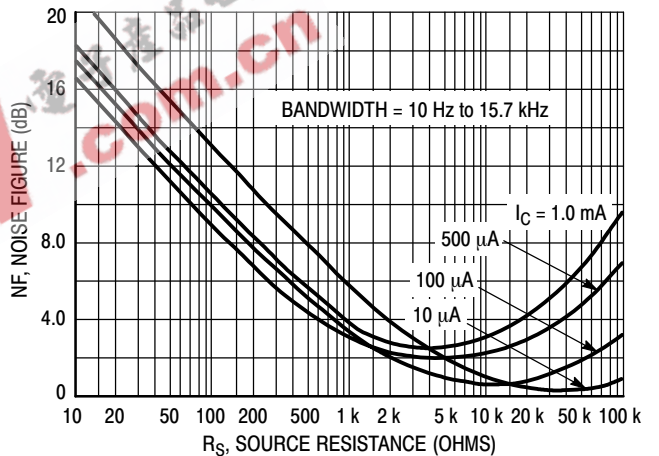


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

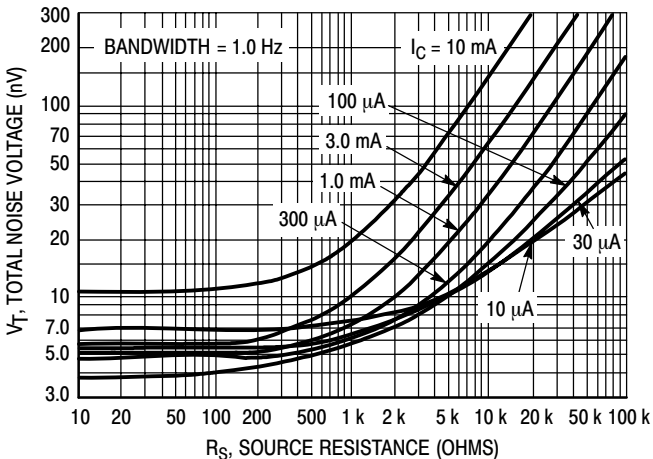


Figure 6. Total Noise Voltage

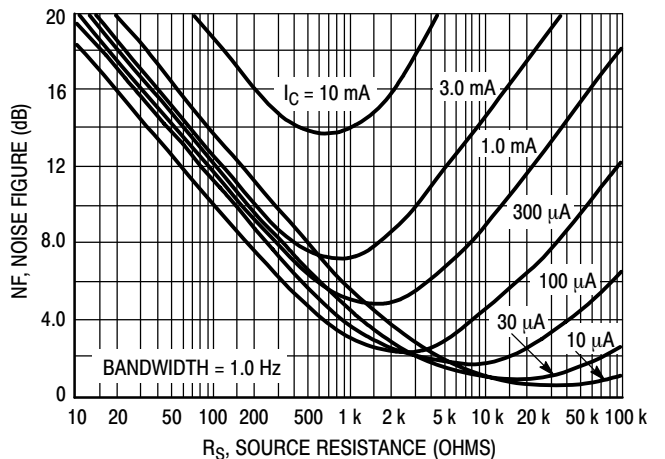


Figure 7. Noise Figure

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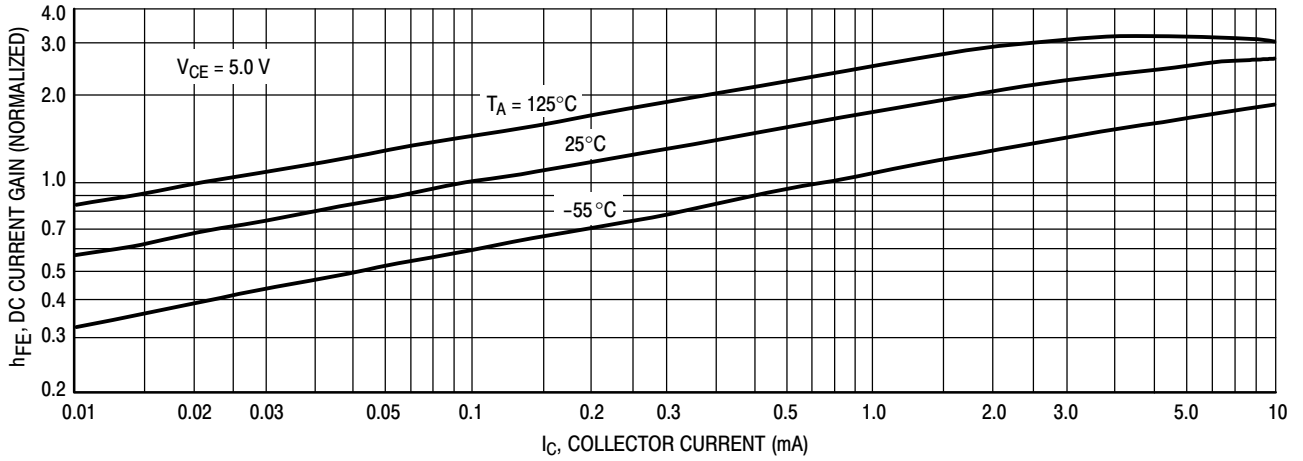


Figure 8. DC Current Gain

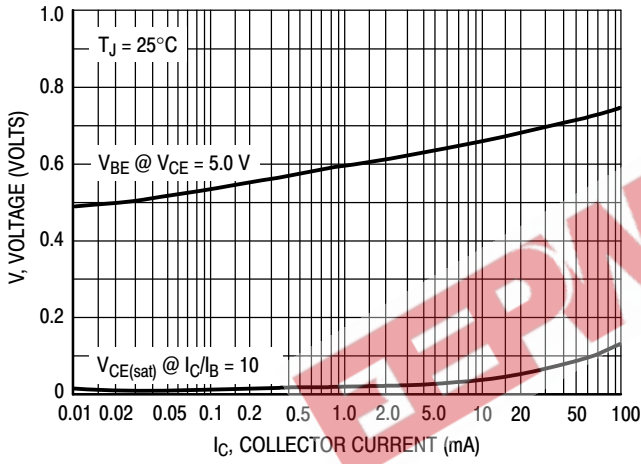


Figure 9. "On" Voltages

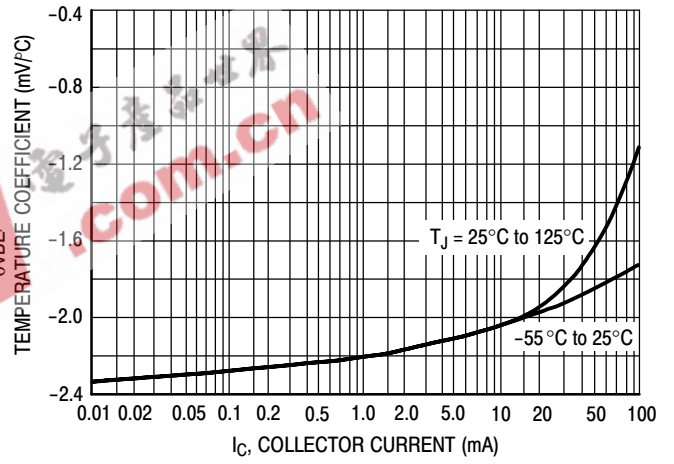


Figure 10. Temperature Coefficients

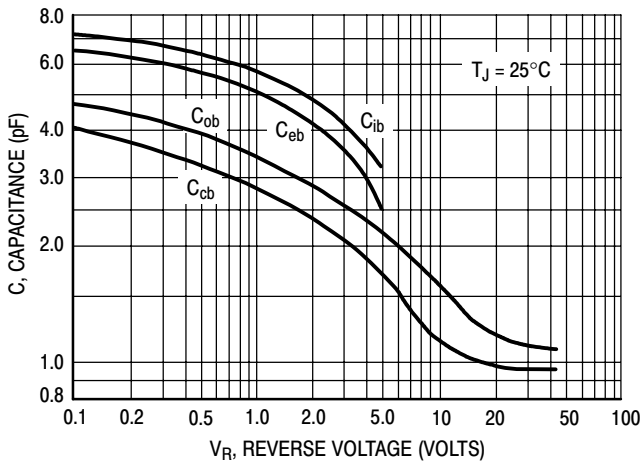


Figure 11. Capacitance

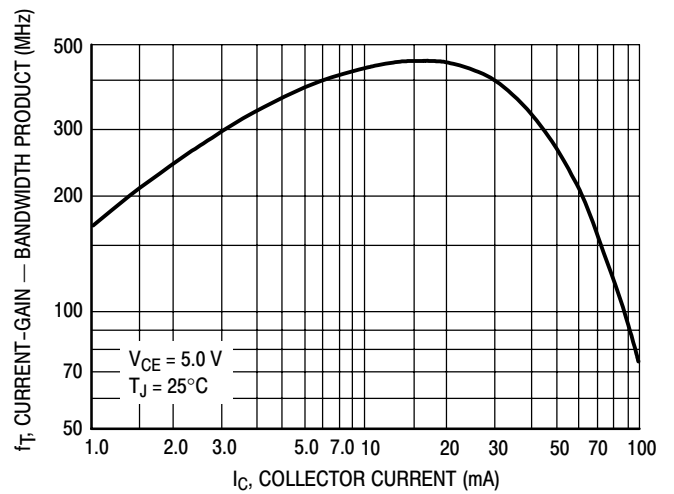
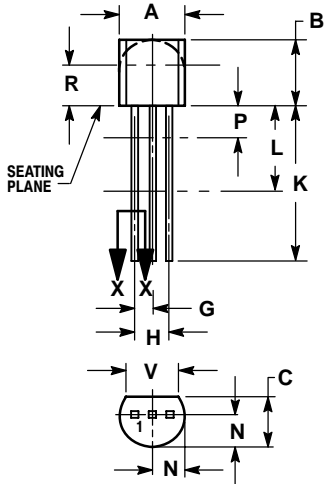


Figure 12. Current-Gain — Bandwidth Product

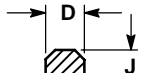
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PACKAGE DIMENSIONS

TO-92 (TO-226)
CASE 29-11
ISSUE AM



STRAIGHT LEAD
BULK PACK

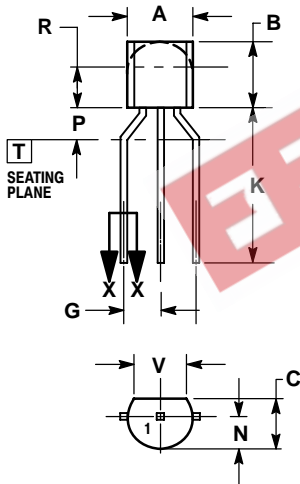


SECTION X-X

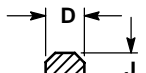
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.060	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---



BENT LEAD
TAPE & REEL
AMMO PACK



SECTION X-X

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	MILLIMETERS	
	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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